

## CLAIMS

1. A method of generating behaviour for an object under the control of a behavioural controller, the method comprising the steps of:

5 receiving input associated with one or more behavioural actions;  
inferring a plurality of behavioural parameter values from said input in accordance with a behavioural framework arranged to generate behaviour by the object;  
deriving output from the inferred plurality of behavioural parameter values; and  
generating equivalent behaviour by the object using the output derived from the  
10 parameter values.

2. A method as claimed in claim 1, wherein the framework has an internally flexible structure.

15 3. A method as claimed in claim 2, wherein the framework comprises a hierarchy of behavioural nodes.

4. A method as claimed in any one of claims 2 or 3, wherein the framework is dynamically flexible.

20 5. A method as claimed in any previous claim, wherein input received is associated with a plurality of behavioural actions, and each parameter values inferred for is determined by a combination of said plurality of behavioural action inputs.

25 6. A method as claimed in any preceding claim, wherein the input comprises a set of at least one behavioural parameter values directly associated with output which generates the behavioural action, wherein in the step of inferring, at least one or more other behavioural parameter values are inferred from which further output is derived to generate equivalent behaviour to the behavioural action.

30 7. A method as claimed in any previous claim, wherein the framework comprises a plurality of nodes, each node associated with a function operating on one or more

parameter values to provide output which modifies a characteristic of the behaviour of the object.

8. A method as claimed in claim 7, wherein the output produced by a function

5 operating on one or more behavioural parameter values provides input to an animation system to generate the behaviour.

9. A method as claimed in claim 7, wherein the function operates on at least one behavioural parameter value assigned uniquely to the node.

10

10. A method as claimed in claim 7, wherein the function operates on at least one behavioural parameter value which is a global parameter value available for use by any node of the framework.

15

11. A method as claimed in claim 10, wherein said global parameter value is associated with a mood state of the object, wherein the characteristic of the behaviour of the object provided by the output of a node of the framework is modified to indicate the mood the object is in.

20

12. A method as claimed in claim 9, wherein the node which generates output from input using a function operating on an internal parameter value associated with a personality trait affecting the characteristic of the behaviour of the object.

25

13. A method as claimed in any one of claims 9 to 12, when dependent on claim 7, wherein the input is received at an output node of the framework, and the received input comprises a set of one or more parameter values directly associated with output generating the behavioural action, and in the step of inferring further parameter values, a reverse mapping is performed from the set of already determined parameter values to infer a further plurality of behavioural parameter values for the internal nodes of the framework.

30

14. A method as claimed in any previous claim, wherein in the step of receiving

input, input is received at a global parameter node of the framework and the nodes of the network map the received input to one or more other nodes to infer a plurality of behavioural parameter values for the one or more other nodes of the framework.

5

15. A method as claimed in claim 1, wherein in the step of generating equivalent behaviour in the object, the equivalent behaviour is generated in an articulate object.

10

16. A method as claimed in any one preceding claim, wherein in the step of generating equivalent behaviour in the object, the equivalent behaviour comprises facially expressive behaviour.

15

17. A method as claimed in any previous claim, wherein the equivalent behaviour by the object comprises a plurality of behavioural actions performed in a predetermined sequence.

18. A method as claimed in claim 17, wherein the equivalent behaviour by the object comprises a plurality of behavioural actions are performed in a random order.

20

19. A method as claimed in any one of claims 16 or 17, wherein the behavioural actions are performed over a period of time.

20. A method as claimed in any one of claims 16 to 17, wherein one or more of said plurality of behavioural actions are performed simultaneously.

25

21. A method as claimed in any previous claim wherein the behaviour includes a behavioural action taken from the group including: eye gaze, limb movement, speech, stance.

30

22. A method as claimed in any previous claim, wherein the received input is derived from a behavioural action by the object which has been induced by direct manipulation of the object by a human user.

23. A method as claimed in any one previous claim, wherein the received input is derived from a behavioural action by one or more other objects interacting with the object.

5 24. A method as claimed in claim 23, wherein the object is a virtual object operating in a virtual environment, wherein the received input is derived from a behavioural action by one or more other articulate virtual objects interacting with the object in the virtual environment.

10 25. A method as claimed in either claim 23 or 24, wherein the plurality of inputs derived from each of said one or more other objects is processed according to a predetermined processing scheme and the result of the processing is used to infer said plurality of behavioural parameter values.

15 26. A method as claimed in claim 25, wherein the processing scheme determines the average of each of said plurality of inputs.

20 27. A method as claimed in any one previous claim, wherein the received input includes input associated with a behavioural action performed by a user of the behavioural controller.

28. A method as claimed in any previous claim, wherein the method further comprises the step of:

25 translating a behavioural action received as input into a culturally equivalent behavioural action, and generating equivalent behaviour to the culturally equivalent behavioural action.

29. A method of controlling the behaviour of an articulate object, the method comprising the steps of:

30 assigning a value to a behavioural parameter set associated with a behavioural characteristic of the object using a behavioural design interface arranged to provide input to a behavioural controller for the object, each said behavioural parameter set comprising at least one parameter affecting the behavioural characteristic;

associating each parameter in the parameter set with a parameter value obtained by performing a function on the assigned value with a default value defined by a behavioural profile;

5       inputting the parameter value to the behavioural controller for the object; inferring from said input, output generated by the behavioural controller; associating the output with a behavioural action by the object; and causing the object to perform the behavioural action.

30.      A method as claimed in claim 29, wherein the function is an identity function.

10

31.      A method of directly manipulating an object to control its behaviour, the method comprising the steps of:

      manipulating the object to perform a behavioural action; providing input representing the behavioural action to an output node of a behavioural framework, the output node being also arranged to provide output which is used to generate equivalent behaviour by the object, mapping the input received by the output node of the behavioural framework within the framework to derive a set of at least one parameter values for other behavioural nodes of the framework;

20       inferring from the set of at least one parameter values derived a set of output values which will generate other equivalent behaviour by the object.

32.      A method of inferring a plurality of internal parameter values for a behavioural controller for an object, the method comprising the steps of:

25       receiving input representing a behavioural action; inferring from said received input a set of at least one output values which corresponds to an equivalent behavioural action by the object; and inferring a value for each said plurality of internal parameters from said set of at least one output values, wherein the value inferred for each said plurality of internal parameters produces output by the behavioural controller resulting in equivalent behaviour to the equivalent behavioural action.

33.      A method of generating behaviour in an object, the method comprising

inferring a plurality of parameter values for a behavioural controller for an object according to the method of claim 32, the method further comprising:

generating said set of output values associated with said equivalent behaviour using said inferred plurality of parameter values; and  
5 causing said articulate object to perform said behaviour.

34. A method of generating behaviour in an object under the control of a behavioural controller comprising a framework of nodes, the method comprising the steps of:

10 at least one node receiving input associated with a behavioural action;  
each said at least one node mapping received input to output;  
inferring a plurality of behavioural parameter values for other nodes in the framework using said output;  
mapping the received input using said inferred behavioural parameter values to provide output by the behavioural controller which generates equivalent behaviour by the object.

15 35. A method of generating behaviour in an object under the control of a behavioural controller, the method comprising the steps of:

20 receiving input associated with a behaviour action;  
mapping said received input to a set at least one output values which corresponds to equivalent behaviour by the object;  
inferring a plurality of behavioural parameter values from said set of at least one output values in accordance with a behavioural framework arranged to generate behaviour by the object; and  
25 generating equivalent behaviour in the object using said parameter values by loading these into the behavioural controller.

36. A method as claimed in any previous claim, wherein the parameters of the behavioural framework are inferred and are time-varying.

30 37. A method as claimed in any previous claim, wherein the parameters values inferred are time-varying.

38. A method as claimed in any preceding claim, wherein the behaviour of the object is generated in real-time in response to receiving input associated with a behavioural action.

5 39. A method as claimed in any preceding claim, wherein the object is a virtual object provided in a virtual environment.

40. A method as claimed in any preceding claim, wherein the object is a robotic object.

10 41. A method as claimed in any preceding claim, wherein the object is selected from the group of objects consisting of:

- a real toy;
- a character in a game;
- an avatar.

15 42. A behavioural controller arranged to generate behaviour in an object, the controller comprising:

- means to receive input associated with a behavioural action;
- 20 means to infer a plurality of behavioural parameter values from said input in accordance with a behavioural framework arranged to generate behaviour by the object;
- means to derive output from the inferred plurality of behavioural parameter values; and
- means to generate equivalent behaviour by the object using the output derived

25 from the parameter values.

43. A behavioural controller as claimed in claim 42, wherein the means to generate equivalent behaviour comprise means to forward the output derived from the parameter values to an animation system arranged to operate on the output to cause the appropriate behaviour to be animated by the object.

30

44. A behavioural controller as claimed in either claim 42 or 43, wherein, said receiving means include means to receive as input at least one parameter value from a source external to the behavioural framework of the object.

5 45. A behavioural controller as claimed in claim 42 to 44, wherein the means to infer a plurality of behavioural parameter values comprises a framework of nodes, each behavioural node arranged to map at least one input parameter value to at least one output parameter value.

10 46. A behavioural controller as claimed in claim 45, wherein at least one node is arranged to map at least one parameter value taken from the group including: a parameter defined for each node within the behavioural framework; a parameter defined within each node of the behavioural framework; and, a parameter defined externally to the behavioural framework.

15 47. A behavioural controller as claimed in any one of claims 42 to 46, wherein said means to receive input is arranged to receive input from a behavioural design interface, the behavioural design interface comprising:

20 means arranged to allow the assignment of a value to a behavioural parameter set comprising at least one behavioural parameter defined according to the behavioural framework of the object; and  
means arranged to operate on the value assigned to the behavioural parameter set by a predetermined function to determine the value of the internal parameter.

25 48. A behavioural controller as claimed in any one of claims 42 to 47, wherein the object is a virtual object arranged to operate within a virtual environment.

49. A behavioural controller as claimed in any one of claims 42 to 48, wherein output from the behavioural controller is provided in a form suitable for being received as input  
30 by a behavioural controller of another object.

50. A behavioural controller as claimed in any one of claims 42 to 50, wherein the behavioural controller further comprises a translation element for mapping received input

derived from behaviour consistent with a first culture to input consistent with a second culture.

51. A behavioural controller as claimed in any one of claims 42 to 50, wherein the

5 behavioural controller further comprises a translation element for mapping behavioural output consistent with a first predefined culture to behavioural output consistent with a second predefined culture.

52. A behavioural controller as claimed in any one of claims 42 to 51, wherein the

10 object is a virtual object arranged to operate within a virtual environment is taken from any one of the group of virtual environments consisting of:

15 a virtual computer game, a virtual on-line meeting, an on-line game, an on-line chat-room, an avatar hosted meeting; an avatar counselling meeting; an avatar based mediation environment; an avatar based sales environment; an on-line collaboration environment; an on-line customer relationship management environment.

53. A behavioural controller as claimed in any one of claims 42 to 52, wherein the

means arranged to receive input comprising a set of at least one behavioural parameter values directly associated with output which generates the behavioural action, wherein

20 the means to infer is arranged to infer at least one or more other behavioural parameter values from which further output is derived to generate equivalent behaviour to the behavioural action.

54. A behavioural controller as claimed in claim 53, wherein the means arranged to

25 receive input receives input comprising at set of at least one behavioural parameter values directly associated with output corresponding to a direct manipulation of the object.

55. A behavioural controller as claimed in any one of claims 42 to 54, wherein a user

30 provides the input to the apparatus.

56. A behavioural controller as claimed in any one of claims 42 to 55, wherein a

software agent provides the input to the apparatus.

57. A behavioural design interface, the interface comprising:

means arranged to allow the assignment of a value to a behavioural parameter set, the parameter set comprising at least one parameter value associated with a behavioural characteristic of the object, wherein the value assigned using the interface is provided as input to the behavioural controller as claimed in any one of claims 42 to 56.

58. A device arranged to have a suite of at least one computer programs stored thereon, the suite of at least one computer programs being executable on the device so as to cause the device to function as a behavioural controller as claimed in any one of claims 42 to 56.

59. A device arranged to have a suite of at least one computer programs stored thereon, the suite of at least one computer programs being executable on the device so as to cause the device to function as a behavioural design interface as claimed in claim 57.

60. A network comprising a plurality of computer-type devices arranged to be capable of communicating with each other, at least one of the devices comprising a device as claimed in either of claims 58 or 59, the other devices being arranged to remotely access at least part of the suite of at least computer programs, to enable objects operating within the environments of said other devices to be controlled by the suite of at least one computer programs.

61. A computer program product comprising a computer program, or a suite of computer programs, comprising a set of instructions to cause one or more computers to perform any one of the methods of any one of claims 1 to 41.

62. A device arranged to have a computer program stored thereon, the computer program being executable on the device so as to cause the device to perform one or more steps in a method as claimed in any one of claims 1 to 41.

63. A virtual environment in which a plurality of virtual objects are arranged to interact under the observation of one or more users participating in the virtual environment, wherein each one of said plurality of virtual objects in the virtual environment displays semi-autonomous behaviour generated using a behavioural system using one or more inputs derived from one or more of the behavioural actions of one or more of the other virtual objects in the virtual environment.

5  
64. A virtual environment as claimed in claim 64, in which each user participating in the virtual environment is able to control the semi-autonomous behaviour generated by 10 providing input to the behavioural system.

15  
65. A platform arranged to support the virtual environment as claimed in claim 64, and providing means for one of said one or more users participating in the virtual environment to provide said input.

66. A platform as claimed in claim 65, wherein the user provides said input via a displayed behavioural design interface, the input received being processed by a behavioural controller arranged to control the behaviour generated by said behavioural system.